FORUM

Pennies for Research Can Cut Dollars From Health Care

The annual outlay for treatment and care of diseases linked to diet exceeds $200 billion. For cardiovascular disease alone, estimated costs are more than $56 billion annually. That's *1,000 times* the USDA budget for human nutrition research.

In spite of our ability to reduce human suffering through dietary changes, the federal investment in human nutrition research has stagnated in real dollars since the early 1980's. I am working to change that. Agricultural Research Service nutrition program leaders have spent long hours planning the agency's future direction for research aimed at reducing the toll of heart disease, cancer, and other diseases of aging.

Nutrition scientists are only beginning, for example, to understand the relationship of plant foods, their phytonutrients, and their role in health.

ARS has already taken a lead role in studying one class of phytonutrients—the carotenoids—measuring and cataloging their levels in U.S. foods and in the human body since the early 1980's. Recent studies at ARS's Western Human Nutrition Research Center found that when women ate too few fruits and vegetables containing beta carotene and other carotenoids, they experienced adverse hormone changes and tissue damage, even though they got ample vitamin A in a supplement.

Researchers at the Human Nutrition Research Center on Aging at Tufts University in Boston are collaborating with Harvard University investigators to determine the effectiveness of carotenoids in breast cancer prevention. And, as you'll read in this issue, research on volunteers at the Beltsville (Maryland) Human Nutrition Research Center indicates that five reasonable-size servings of carotenoid-rich foods daily can raise levels of several carotenoids in blood serum and colon cells and significantly improve immune capacity.

In other studies at Beltsville, researchers have discovered that two carotenoids—lutein and zeaxanthin—are strong antioxidants. And they are the only carotenoids found in the retina of the human eye, suggesting that they may protect against a condition that leads to blindness in many elderly people.

But carotenoids are only one class of compounds among the more than 600 phytonutrients in fruits, vegetables, beans, grains, and seeds.

These compounds include a wide range of chemical structures and protect us by different modes of action. In addition to acting as antioxidants, they may boost the immune system or encourage enzymes that detoxify carcinogens or bind to excess estrogen that might otherwise promote cancers in the breast and other tissues.

Identifying individual phytonutrients that are most beneficial to the human body and determining their modus operandi are major issues for future study. But a group of researchers at the Boston center has taken a different approach. Using a sensitive chemical assay they developed, they measured the total antioxidant capacity of whole foods. It turned out that the most potent foods have dozens to hundreds of active compounds, many belonging to another class of pigments known as flavonoids. Animal studies are now in progress to see if this potency in the laboratory translates to antioxidant protection in living systems.

With such a vast array of phytonutrients, many of which are still unknown, it becomes obvious why it is so important to eat a variety of plant foods rather than rely on supplements. ARS research will continue to identify the most beneficial compounds, how they function and how to measure that function, how much we need for optimal protection, what combinations of foods enhance their absorption by the human body, and how this bioavailability is affected by cooking or storage.

As more of this information becomes available, other sectors of ARS can increase the amounts of phytonutrients we consume. One way is through plant breeding: We've already produced varieties of tomatoes, sweetpotatoes, corn, carrots, and cantaloupes with increased total carotene content. Our scientists have also identified carotene-containing germplasm for vegetables that typically contain no carotene, including cauliflower, cucumbers, and potatoes.

Soil nutrient levels and availability play a role in phytonutrient levels. Food processing is another potential route for increasing intake—either by adding phytonutrients as food ingredients or by preventing their loss. And postharvest research can find ways of maintaining high levels through shipping and storage.

With extensive research in all these areas, ARS researchers are in a pivotal position to conduct, collaborate in, and coordinate studies aimed at improving the nutritional content of our food supply. In the agricultural sector, history has shown that dollars spent on ARS research have multiplied in productivity and products. I have no doubt that we can continue our record and help cut health-care costs through adequately funded research into phytonutrients and nutrition in general.

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